Modeling Knowledge Work: Case Management and Decision-aware Business Processes

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About Me
Well-known things from Switzerland
The Ultimate Swiss Armee Knife
About Me

- Head of MSc in Business Information Systems
- Research Associate at University of Pretoria
- Adjunct Professor at University Camerino

Topics:
- Enterprise Modelling
- Business Processes and Knowledge Work
- Alignment of Business and IT
Motivation

- Knowledge work is key to the success of many enterprises
  - differentiate physical goods
  - offer smart services
- One way to manage knowledge work is to treat it as a process.
- Business Process Management, however, is often regarded as incompatible with the autonomy and work approaches of knowledge workers.
Work Patterns of Knowledge Workers

Most of a knowledge worker’s day is spent in unstructured work

- Purely Ad-Hoc, Never Happens the Same Way Twice: 35%
- Consistent, Defined Goals; Varying Means to Achieve: 28%
- Documented and Managed, but Not Automated: 20%
- Partially Automated, but Frequent Exceptions: 15%
- Fully Automated, Lack of Opportunity to Change: 9%

2/3 of a Knowledge Worker’s Day is Spent in Unstructured & Often Unpredictable Work Patterns

Roughly 1/3 is Structured, Predictable, Automated or Automatable

Source: 2011 - 2013 Case Management Survey
## Types of Knowledge Work

<table>
<thead>
<tr>
<th>Integration Model</th>
<th>Collaboration Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systematic, repeatable work</td>
<td>Improvisational work</td>
</tr>
<tr>
<td>Highly reliant on formal processes, methodologies or standards</td>
<td>Highly reliant on deep expertise across multiple functional areas</td>
</tr>
<tr>
<td>Dependent on tight integration across functional boundaries</td>
<td>Dependent on fluid deployment of flexible teams</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transaction Model</th>
<th>Expert Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine work</td>
<td>Judgement-oriented work</td>
</tr>
<tr>
<td>Highly reliant on formal rules, procedures and training</td>
<td>Highly reliant on individual expertise and experience</td>
</tr>
<tr>
<td>Dependent on low discretion workforce or automation</td>
<td>Dependent on star performers</td>
</tr>
</tbody>
</table>

(Davenport 2010)

### Complexity of Work

- Routine
- Interpretation/Judgment
Modeling Business Processes
## Classification of Processes

<table>
<thead>
<tr>
<th><strong>structured process</strong></th>
<th><strong>case</strong></th>
<th><strong>ad hoc process</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- structured process flow</td>
<td>- process flow can partly be structured</td>
<td>- process flow cannot be structured – new tasks on the fly</td>
</tr>
<tr>
<td>- activities known in advance</td>
<td>- activities partly known in advance</td>
<td>- activities partly known in advance</td>
</tr>
<tr>
<td>- many repetitive elements</td>
<td>- some repetitive elements</td>
<td>- few repetitive elements</td>
</tr>
<tr>
<td>- no degree of freedom for people wrt process flow</td>
<td>- some degree of freedom for people wrt process flow</td>
<td>- very high degree of freedom for people wrt process flow</td>
</tr>
</tbody>
</table>

- can be modelled
- cannot be modelled

partly translated from (Gadatsch 2005, S. 44)
Structure of Processes

*structured process*

*case*

*ad hoc process*

- process flow cannot be structured – new tasks on the fly
- activities partly known in advance
- few repetitive elements
- very high degree of freedom for people wrt process flow

can be modelled

cannot be modelled

partly translated from (Gadatsch 2005, S. 44)
Process Logic and Business Logic

knowledge about processes:
• process flow
• roles
• resources
→ process logic

knowledge in processes:
• supports practice
• skills, experiences
• know how
→ business logic
Types of Knowledge Work

Objective: Integration

(Davenport 2010)
Agility of a Sports Team

- A good player must
  - **sense** what is happening
  - **prioritize** best next action
  - **act** effectively

- A playbook defines moves
- But: moves depend on the opponent
- Playbook corresponds to
  - Business process model (process logic)
  - decision model (business logic)
  - but must allow for **flexibility**

based on an idea from (Cauley 2010)
Analogy: Sports Team

Agility in different levels:

♦ (Re-)Define moves/processes
  ➢ process/decision logic
  ➢ design time

♦ Adapt moves/processes
  ➢ process logic
  ➢ run time

♦ flexibly react on opportunity or threat
  ➢ decision logic
  ➢ run time

adapted from (Cauley 2010)
Example:
Check Eligibility of MSc Candidates
Exercise: Check Eligibility of MSc Candidates

- First, the study assistant confirms that the application has arrived.
- The study assistant determines whether the bachelor degree is ok. If the degree is unknown to the study assistant, she can look in the degree database or ask public authorities.
- It is checked whether the average grade is at least “good”.
- The average grade is calculated, if it is not in the transcript.
- The study assistant has to register the student.
- The study assistant can discuss with the head of program at any time.
- The head of program decides, whether the candidate is eligible.

What is the base process?
- Which tasks are executed in every case?
- Which tasks are executed for specific cases?
Exercise: Check Eligibility of MSc Candidates

- First, the study assistant **confirms that the application** has arrived.
- **The study assistant determines** whether the bachelor degree **is ok.** The degree is unknown to the study assistant, she can look in the degree database or ask public authorities.
- It is **checked whether the average grade is at least “good”**.
- The **average grade is calculated**, if it is not in the transcript.
- The study assistant has to **register the student**.
- The study assistant can discuss with the head of program **at any time**.
- The head of program **decides**, whether the candidate is eligible.

---

**The tasks in bold are the basic process:**
- **Tasks executed in every case**
- **Tasks executed for specific cases**
Basic Process in BPMN

[Diagram of a process flow showing steps from 'Check eligibility' to 'Head of Program'.]

- Application arrived
- Study assistant
- Confirm application
- Check bachelor degree
- Check grade
- Calculate average grade
- Decide eligibility
- Register candidate
Exercise: Check Eligibility of MSc Candidates

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Which tasks depend on experience, preference or judgment of human worker?
Exercise: Check Eligibility of MSc Candidates

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Tasks in bold depend on experience, preference or judgment of human worker
Process as BPMN including Discretionary Items

Problems:
- Main elements cannot be distinguished from parts dependent on the human
- Criteria for execution of discretionary depend on human judgment or preference. → gateways not adequate
Modelling with CMMN
CMMN - Case Management Model and Notation

- OMG defined a Modeling Standard for Case Modeling
  - Case Management Model and Notation (CMMN)
- Version 1.1 is from December 2016
  - http://www.omg.org/spec/CMMN/1.1/PDF/
- CMMN is specialized notation to model cases. It is independent from BPMN
Design Time vs Run Time = Modeling vs Planning

- A Case has two distinct phases: design-time and run-time
  - **Design-time:** *Business analysts* define
    - Tasks of pre-defined segments
    - “discretionary” Tasks that are additionally available to the Case worker
  - **Run-time:** *Case workers* execute the plan
    - performing Tasks based on control flow criteria,
    - adding discretionary Tasks if needed.

![Diagram](image.png)

- **Design-time phase:**
  - **Modeling**
    - Plan Items
      - A
      - B
      - C
      - D
  - Discretionary Items

- **Run-time phase:**
  - **Plan**
    - A
    - B
  - **Planning**
    - C, D
    - A case worker can add one or more instances of C and/or D to the plan
  - This is the plan to be executed

*(CMMN 1.0, p. 5f)*
CMMN Case Plan Modelling in the Knowledge Work Designer

case plan model
Discretionary Tasks: Freedom for Worker

Check Eligibility

Application arrived

Confirm application

Check bachelor degree

Look in degree database

Ask public authority

Calculate average grade

Check grade

Decide eligibility

Discuss with HoP

Register candidate
CMMN Case Plan Modelling in the Knowledge Work Designer

case plan model

planning elements
support human planner
Planning Table and Applicability Rules

- Relation of Planning Table, Discretionary Item and Applicability Rules in the Knowledge Model Designer
Case Management Processes: Examples

Case management processes: common in many industry segments, where activities and documents required depend on the circumstances of each case

♦ Benefits Administration
  ● Examples: welfare assistance, student financial aid, grants programs, disability benefits

♦ Underwriting
  ● Examples: commercial lending, life and disability insurance.

♦ Project Management
  ● Examples: launch of a new product/service, major IT system upgrade

♦ Dispute Resolution
  ● Example: customer demands a refund

(Silver 2011, p. 88f)
BPMN and CMMN
CMMN for Subprocesses in BPMN
## Comparing Elements of BPMN and CMMN

<table>
<thead>
<tr>
<th></th>
<th>BPMN</th>
<th>CMMN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tasks</strong></td>
<td>Tasks</td>
<td>Tasks</td>
</tr>
<tr>
<td><strong>Process hierarchy</strong></td>
<td>Subprocesses, Call Activities</td>
<td>Process Tasks, Case Tasks</td>
</tr>
<tr>
<td><strong>Events</strong></td>
<td>Events: start – intermediate – end catching – throwing</td>
<td>Event Listeners, implicit Events, Milestones</td>
</tr>
<tr>
<td><strong>Control Flow</strong></td>
<td>Gateways/Events</td>
<td>Sentries</td>
</tr>
<tr>
<td><strong>Sequence Flow</strong></td>
<td><img src="image" alt="Sequence Flow Diagram" /></td>
<td><img src="image" alt="Sentry with empty condition" /></td>
</tr>
<tr>
<td><strong>Planning</strong></td>
<td>--</td>
<td>Discretionary Tasks</td>
</tr>
<tr>
<td><strong>Responsibilities</strong></td>
<td>Lanes</td>
<td>Role attribute</td>
</tr>
<tr>
<td><strong>Process Container</strong></td>
<td>Pool</td>
<td>Folder</td>
</tr>
</tbody>
</table>
## Rules in BPMN and CMMN

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<tr>
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<tbody>
<tr>
<td>Events/gateways</td>
<td>Sentries</td>
</tr>
<tr>
<td>---</td>
<td>Applicability rules (planning tables)</td>
</tr>
<tr>
<td>Business rules (task)</td>
<td>Decision (task)</td>
</tr>
</tbody>
</table>
Implicit Control Flow in CMMN

What does it mean?

Visible conditions are better for understanding
Explicit Control Flow in BPMN

What does it mean?
BPCMN: A combined Process and Case Modeling Language

A combination of control flow elements of BPMN and discretionary tasks and planning elements of CMMN

a suitable language to deal with any kind of process.
BPCMN – Combining BPMN and CMMN
Decision-aware Business Processes
Decision Tasks in Business Processes

- A **decision task** is a task in which some decision is made.
- Two kinds of decision tasks:
  - Decision tasks deriving values for data
  - Decision tasks providing data for gateways

Decision: Is the applicant eligible?
Decision: what is the amount of the insurance premium in this case?
**Decision-Aware Process Models:** Managing Process Logic and Decision Logic Separately

- The process model contains the process logic → **procedural**
- Decision logic represented in a different kind of model → **declarative**
- Separating business decisions from business process tasks
  - simplifies the business process model
  - allows to manage business logic in a declarative form

**Process Logic**

**Business Logic / Decision Logic**
Example:
Decision-aware Process
Exercise: Decisions in Processes (1)
Process Logic vs Business Logic

- How many decisions are made in this process?
- Which business logic can you identify?
- What would you improve?
Exercise: Decisions in Processes (2)
Process Logic vs Business Logic

- A process model contains **process logic**

- This process only contains **one** decision wrt. process logic:
  - Execute «Reject candidate» or execute «Invite candidate»

- The criteria for the decision are written on the gateways. This is business logic and not process logic. It should not be part of process model.
  - Change in the criteria should not affect the process model.
  - The order of the criteria is not compulsory. There is an unnecessary sequentialisation.
Exercise: Decisions in Processes (3)
Process Logic vs Business Logic

Process logic:

Business logic:

- This model is more appropriate
  - Process is simplified
  - Decision logic is modeled separately
  - Change of business (decision) logic does not affect process model
Advantages of separating Business Logic from Business Process Model

- Allows a much simpler business process model
  - If a business process is too complicated, a reason might be that business rules are embedded in the flow

- Makes changes to business process and business logic easier
  - Permits changes in the Decision Model without changing the business process model and vice versa

- Makes governance of business processes and business logic easier to manage

- Decision Model can be reused in several processes
  - the whole decision model
  - individual decision tables and rules
Modelling Decision Logic
Decision Model and Notation

Decision Requirements Diagram

- Candidate Eligible
- Eligibility Rules
- Bachelor Degree
- Study Regulation
- Data Form

Decision Tables

<table>
<thead>
<tr>
<th>Candidate Eligible</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bachelor Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
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</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>
Decision Model and Notation

Decision Requirements Diagram

- Candidate Eligible
  - Eligibility Rules
  - Bachelor Degree
    - Study Regulation
    - Data Form

Decision Tables

<table>
<thead>
<tr>
<th>Candidate Eligible</th>
<th>Bachelor Degree</th>
<th>University accredited</th>
<th>eligible</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC</td>
<td>yes, no</td>
<td>yes, no, unclear</td>
<td>yes, no</td>
</tr>
<tr>
<td>1</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>2</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>3</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>4</td>
<td>yes</td>
<td>unclear</td>
<td>yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bachelor Degree</th>
<th>Bachelor Degree in</th>
<th>Bachelor Degree in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Systems</td>
<td>Information Systems</td>
<td>yes, no</td>
</tr>
<tr>
<td>Business Administration</td>
<td>Business Administration</td>
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<tr>
<td>Information Technology</td>
<td>Information Technology</td>
<td>yes</td>
</tr>
<tr>
<td>other</td>
<td>other</td>
<td>yes</td>
</tr>
<tr>
<td>none</td>
<td>none</td>
<td>no</td>
</tr>
</tbody>
</table>

Documents in Case File

- Application form
- Transcript of record
- Acceptance letter
- Study regulations
- Recommendation form
- Personal data form
References to Decision Models

- Decision models can be referenced from
  - Process models
  - Case plan models
  - BPCMN models
Decisions requiring Human Judgment

- Some decisions require human judgment
  - Example: Communication and analytical skills
- Can be supported by …
  - Checklists
  - Best practices
  - Lessons learned
- Modelled as documents
Decisions requiring Human Judgment

<table>
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<tbody>
<tr>
<td>1</td>
<td>Information Systems, Business Administration</td>
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</tr>
<tr>
<td>2</td>
<td>Information Systems</td>
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</tr>
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<td>4</td>
<td>yes</td>
<td>unclear</td>
<td>yes</td>
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</table>
Conclusion

- Modeling of Knowledge Work includes
  - process logic and business Logic
  - on different degrees of structure
in an integrated environment

The modeling language was developed in adoxx.org
Model types of the Knowledge Work Designer

- **Business Process Modelling** (BPMN)
- **Process and Case Modelling** (BPCMN)
- **Case Management Modelling** (CMMN)
- **Decision Modelling** (DMN)
- **Document Modelling**
- **Organisation Modelling**

Control Elements
Planning Elements

NEMO 2017 - Knowledge Work Designer
For the latest material see:

http://knut.hinkelmann.ch/lectures/nemo2017/
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